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DESCRIPTION

LAMINATED CERAMIC ELECTRONIC COMPONENT AND METHOD FOR PRODUCING THE SAME

Technical Field

The present invention relates to a laminated ceramic electronic component, and in particular, to a laminated ceramic electronic component such as a laminated inductor, a laminated impedance component, a laminated transformer, and a high frequency line device, and a method for producing the same.

Background Art

In general, a laminated ceramic electronic component such as a laminated inductor is produced as follows. Firstly, a mother ceramic laminated block composed of a plurality of ceramic laminated products is formed. The mother ceramic laminated block is cut according to the arrangement of inner conductors such as conductors for a coil and leading conductors to provide each ceramic laminated product. The resultant ceramic laminated product is fired. Subsequently, outer electrodes are formed on the surface of the ceramic laminated product to provide a final product.

When the inner conductors and the leading conductors are formed by normal screen printing, the conductors have a thickness of about 20 μm. In such a thickness, when the

mother ceramic laminated block is cut, mechanical stress applied to the leading conductors is small. Therefore, defects such as cracking are not generated.

Patent Document 1 discloses a method for producing a conductor for a coil. According to the method, a conductor layer for a coil integrated with a leading portion is transferred a plurality of times so as to overlap each other. Thus, a conductor for a coil having a conductor thickness after the firing of, for example, about 70 to about 80 μm is produced.

However, in such a large thickness of the conductor, when the mother ceramic laminated block is cut, excessive mechanical stress is applied to the leading portion of the conductor for a coil. As a result, defects such as cracking are easily generated.

Further, it is known that ferrite has the magnetostrictive effect in which the permeability is changed depending on the stress. The production of a laminated ceramic electronic component has the following problem. When laminated green sheets composed of ferrite and inner conductors are fired, stress due to the difference in the shrinking behavior is applied to the ferrite. Consequently, the permeability of the ferrite is decreased.

Patent Document 1: Japanese Unexamined Patent Application Publication No. 2002-305123

Disclosure of Invention

Problems to be Solved by the Invention

Accordingly, it is an object of the present invention to provide a laminated ceramic electronic component having a structure wherein excessive mechanical stress is not readily applied to a leading conductor during the cutting and a method for producing the same.

In addition to the above object, it is another object of the present invention to provide a method for producing a laminated ceramic electronic component wherein the decrease in the permeability due to the magnetostrictive effect can be prevented.

Means for Solving the Problems

In order to achieve the above object, a laminated ceramic electronic component of the present invention includes an inner conductor provided inside of a ceramic laminated product, an outer electrode provided on the surface of the ceramic laminated product, and a leading conductor connecting the inner conductor to the outer electrode, wherein the thickness of the leading conductor is smaller than the thickness of the inner conductor. Examples of the inner conductor include a conductor for a coil and a high frequency line conductor such as a strip line.

According to the above structure, the thickness of the leading conductor is small. Therefore, although mechanical

stress during the cutting is directly applied to the leading conductor, the mechanical stress applied to the leading conductor during the cutting can be reduced.

A method for producing a laminated ceramic electronic component according to the present invention includes the steps of preparing ceramic green sheets; transferring an inner conductor pattern layer and a leading conductor pattern layer formed on a support on the ceramic green sheets in order to form the inner conductor and the leading conductor on the ceramic green sheets; laminating the ceramic green sheets so as to cover the inner conductor and the leading conductor; and firing the ceramic laminated product. In the step of forming the inner conductor and the leading conductor, the inner conductor pattern layer is transferred on the ceramic green sheet a plurality of times so as to overlap each other, thereby forming the inner conductor. In addition, the leading conductor pattern layer is transferred on the ceramic green sheet, wherein the number of times of the transferring is smaller than the number of times of the transferring of the inner conductor pattern layer, thereby forming the leading conductor having a thickness smaller than the thickness of the inner conductor.

In the mass production, the ceramic laminated product formed by laminating a plurality of ceramic green sheets is

provided as a mother ceramic laminated block composed of a plurality of ceramic laminated products. The mother ceramic laminated block is cut according to the arrangement of the inner conductor formed inside thereof to provide each ceramic laminated product. The resultant ceramic laminated product is then fired.

According to the above method, a laminated ceramic electronic component wherein the thickness of the inner conductor is larger than that of a normal one and the thickness of the leading conductor is smaller than that of the inner conductor can be readily produced.

A small thickness of the leading conductor decreases the cross-sectional area of the leading conductor to increase the direct current resistance. Accordingly, the conductor width of the leading conductor is preferably larger than the conductor width of the inner conductor. Thus, the decrease in the cross-sectional area of the leading conductor can be compensated. As a result, the increase in the direct current resistance caused by decreasing the thickness of the leading conductor can be prevented.

The metal content of conductive paste used for forming the leading conductor pattern layer may be higher than that of conductive paste used for forming the inner conductor pattern layer. Even if cracks are generated on the leading

portion during the cutting, the conductive paste is melted during the firing and a metal in the conductive paste can fill the cracks.

Among the inner conductor pattern layers, at least the inner conductor pattern layer that is brought into contact with the ceramic green sheet may be formed with conductive paste including resin particles that are lost by being fired in the firing process. When the resin particles are lost by being fired in the firing process, a space is formed between the ceramic green sheet and the inner conductor. As a result, the stress applied to the ceramic green sheet (ferrite) can be reduced to prevent the decrease in the permeability due to the magnetostrictive effect. Furthermore, the formation of this space can prevent cracks from generating on the inner conductor.

Advantages

As described above, according to the present invention, the thickness of a leading conductor is smaller than that of an inner conductor. Accordingly, the mechanical stress applied to the leading conductor during the cutting can be reduced. As a result, defects such as cracking generated on the leading conductor during the cutting can be prevented.

In addition, among inner conductor pattern layers, at least an inner conductor pattern layer that is brought into contact with ceramic green sheets is formed with conductive

paste including resin particles that are lost by being fired in the firing process. Accordingly, the decrease in the permeability due to the magnetostrictive effect can be prevented.

Brief Description of the Drawings

[Fig. 1] Fig. 1 is an exploded perspective view for explaining an embodiment of a laminated ceramic electronic component according to the present invention.

[Fig. 2] Fig. 2 is an outside perspective view of the laminated ceramic electronic component shown in Fig. 1.

[Fig. 3] Fig. 3 is a perspective plan view of the inside of the laminated ceramic electronic component shown in Fig. 1.

[Fig. 4] Fig. 4 is a schematic cross-sectional view showing an example of a method for producing a laminated ceramic electronic component according to the present invention.

[Fig. 5] Fig. 5 is a schematic cross-sectional view showing the step following the step shown in Fig. 4.

[Fig. 6] Fig. 6 is a schematic cross-sectional view showing the step following the step shown in Fig. 5.

[Fig. 7] Fig. 7 is a schematic cross-sectional view showing the step following the step shown in Fig. 6.

[Fig. 8] Fig. 8 is a schematic cross-sectional view showing the step following the step shown in Fig. 7.

[Fig. 9] Fig. 9 is a schematic cross-sectional view showing the step following the step shown in Fig. 8.

[Fig. 10] Fig. 10 is a schematic cross-sectional view showing the step following the step shown in Fig. 9.

[Fig. 11] Fig. 11 is a schematic cross-sectional view showing the step following the step shown in Fig. 10.

[Fig. 12] Fig. 12 is a schematic cross-sectional view showing the step following the step shown in Fig. 11.

[Fig. 13] Fig. 13 is a schematic cross-sectional view showing the step following the step shown in Fig. 12.

[Fig. 14] Fig. 14 is a schematic cross-sectional view showing the step following the step shown in Fig. 13.

[Fig. 15] Fig. 15 is a schematic cross-sectional view showing the step following the step shown in Fig. 14.

[Fig. 16] Fig. 16 is a perspective view showing an example of a connecting relationship between conductor pattern layers for a coil and leading pattern layers that is preferable to prevent the decrease in permeability.

[Fig. 17] Fig. 17 includes plan views showing modifications.

Best Mode for Carrying Out the Invention

Embodiments of a laminated ceramic electronic component according to the present invention and a method for producing the same will now be described with reference to the attached drawings.

As shown in Fig. 1, a laminated inductor 1 includes, for example, conductor pattern layers 2, 3, and 4 for a coil, leading conductor pattern layers 5 and 6, and ceramic green

sheets 10, 11, and 12. Reference numeral 21 indicates a support (carrier film). As will be described below, the support (carrier film) 21 is eventually removed and does not form the laminated inductor 1.

The ceramic green sheets 10 to 12 are formed as follows. For example, a Fe-Ni-Cu-containing ferrite powder or a glass ceramic powder is mixed with a binder. The mixture is formed by, for example, a doctor blade method so as to have a sheet shape. The ceramic green sheets 12 are used for outer layers, whereas the ceramic green sheets 10 and 11 are used as interlayers.

Via holes 15 for interlayer connection are provided in the ceramic green sheets 10 and 11 serving as the interlayers. The via holes 15 for interlayer connection are formed as follows. Through-holes are formed in the sheets 10 and 11 with, for example, a laser beam. Conductive paste containing, for example, Ag, Pd, Cu, Au, or an alloy thereof is then filled in the through-holes by printing etc.

In order to form each of the conductor pattern layers 2, 3, and 4 for a coil and the leading conductor pattern layers 5 and 6, conductive paste is applied on a support composed of a PET film or a PP film by, for example, screen printing or photolithography. These conductor pattern layers 2 to 6 are composed of, for example, Ag, Pd, Cu, Au, or an alloy thereof. In this embodiment, the conductor pattern layers 2,

3, and 4 for a coil have a U shape. Alternatively, the conductor pattern layers 2, 3, and 4 for a coil may have, for example, a straight line shape, a circular arc shape, or a spiral shape.

Furthermore, in this embodiment, the metal content (i.e., the ratio of metal powder to the total amount of paste) of conductive paste used for forming the leading conductor pattern layers 5 and 6 is higher than that of conductive paste used for forming the conductor pattern layers 2 to 4 for a coil. More specifically, for example, the metal content of the conductive paste used for forming the conductor pattern layers 2 to 4 for a coil is 50%. On the other hand, the metal content of the conductive paste used for forming the leading conductor pattern layers 5 and 6 is 70%.

The conductive paste having a high metal content has the following advantage: Even if cracks are generated on the leading conductor pattern layer 5 or 6 during the cutting, the conductive paste is melted during the firing and the metal powder etc. in the conductive paste fills the cracks. Accordingly, connection defects can be prevented more effectively. In contrast, in the conductive paste having a low metal content, even when the conductive paste is melted during the firing, the crack cannot be filled satisfactorily because the amount of the metal powder is

insufficient. In addition, since the conductive paste having a high metal content is expensive; such conductive paste is used for only the leading conductor pattern layers 5 and 6 wherein cracks are generated easily.

A plurality of conductor pattern layers 2, 3, and 4 for a coil overlaps each other to form U-shaped conductors 2A, 3A, and 4A for a coil. The conductors 2A, 3A, and 4A for a coil are electrically connected in series with the via holes 15 for interlayer connection provided in the ceramic green sheets 10 and 11 to form a spiral coil L. The coil axis of the coil L is directed in the direction parallel to the laminated direction of the sheets 10 to 12.

Meanwhile, a plurality of leading conductor pattern layers 5 and 6 also overlaps each other to form leading conductors 5A and 6A. One end of the leading conductor 5A is exposed on the right side of the sheets 12. Another end of the leading conductor 5A is electrically connected to an end of the conductor 2A for the coil. In other words, one leading conductor pattern layer 5 is disposed per predetermined number (two layers in this embodiment) of conductor pattern layers 2 for the coil, and an end 51 of each leading conductor pattern layer 5 is in contact with the corresponding conductor pattern layer 2 for the coil. This structure increases the contact area between the leading conductor 5A and the conductor 2A for the coil. As

a result, the leading conductor 5A is electrically connected to the conductor 2A for the coil reliably.

In the same way, one end of the leading conductor 6A is exposed on the left side of the sheets 12. Another end of the leading conductor 6A is electrically connected to an end of the conductor 4A for the coil. In other words, one leading conductor pattern layer 6 is disposed per predetermined number of conductor pattern layers 4 for the coil, and an end 61 of each leading conductor pattern layer 6 is in contact with the corresponding conductor pattern layer 4 for the coil.

In other words, the thickness of the leading conductors 5A and 6A is smaller than that of the conductors 2A to 4A for the coil. More specifically, the conductor pattern layers 2 to 4 for the coil and the leading conductor pattern layers 5 and 6 are formed so as to have a thickness of about 10 μm. In addition, the number of overlaps for each conductor pattern layer 2, 3, or 4 for the coil is about 10. Consequently, after the firing, each of the conductors 2A to 4A for the coil has a thickness of about 70 to about 80 μm. On the other hand, the number of overlaps for leading conductor pattern layer 5 is about 5. Consequently, after the firing, each of the leading conductors 5A and 6A has a thickness of about 35 to about 40 μm.

Since the leading conductors 5 and 6 have a small

thickness, as will be described below, mechanical stress applied to the leading conductors 5A and 6A during the cutting can be reduced. Accordingly, the generation of cracks on the leading conductors 5A and 6A during the cutting can be prevented.

Furthermore, the leading conductor pattern layers 5 and 6 have a conductor width larger than the conductor width of the conductor pattern layers 2 to 4 for the coil. Therefore, the conductor width of the leading conductors 5A and 6A is larger than the conductor width of the conductors 2A to 4A for the coil.

A small thickness of the leading conductors 5A and 6A decreases the cross-sectional area of the leading conductors 5A and 6A to increase the direct current resistance. Accordingly, the leading conductors 5A and 6A have a conductor width larger than that of the conductors 2A to 4A for the coil in order to compensate the decrease in the cross-sectional area of the leading conductors 5A and 6A. Thus, the increase in the direct current resistance caused by decreasing the thickness of the leading conductors 5A and 6A is prevented.

The conductor pattern layers 2, 3 and 4 for the coil, the leading conductor pattern layers 5 and 6, and the ceramic green sheets 10, 11, and 12 are laminated as shown in Fig. 1. The laminated product is then fired as a single

component to provide a ceramic laminated product 30 having a rectangular parallelepiped shape, as shown in Fig. 2. Input-output outer electrodes 31 and 32 are provided at right and left end faces of the ceramic laminated product 30. As shown in Fig. 3, both ends of the spiral coil L are electrically connected to the input-output outer electrodes 31 and 32, with the leading conductors 5A and 6A therebetween.

A method for producing the laminated inductor 1 having the above structure will now be described with reference to Figs. 4 to 15. Figs. 4 to 15 show only a single ceramic laminated product. In the actual process, however, a mother ceramic laminated block including a plurality of ceramic laminated products is formed. Subsequently, the mother ceramic laminated block is cut according to the arrangement of the conductors 2A to 4A for a coil and the leading conductors 5A and 6A to provide each ceramic laminated product.

Firstly, a plurality of ceramic green sheets 12 is laminated and compression bonded to provide a mother ceramic outer layer block 12A (see Fig. 4). Subsequently, as shown in Fig. 5, a leading conductor pattern layer 5 is disposed on the mother ceramic outer layer block 12A so that a support 21 is disposed at the upper side. The resultant mother ceramic outer layer block 12A is then compression

bonded by a pressing machine to embed the leading conductor pattern layer 5 in the mother ceramic outer layer block 12A. The support 21 is then peeled off. Thus, the leading conductor pattern layer 5 is transferred on the mother ceramic outer layer block 12A.

Subsequently, as shown in Fig. 6, a conductor pattern layer 2 for a coil is disposed on the mother ceramic outer layer block 12A such that an end of the conductor pattern layer 2 for the coil is in contact with an end 51 of the leading conductor pattern layer 5. Herein, the conductor pattern layer 2 for the coil is disposed so that a support 21 is disposed at the upper side. Subsequently, the conductor pattern layer 2 for the coil is embedded in the mother ceramic outer layer block 12A by compression bonding. The support 21 is then peeled off. Thus, the conductor pattern layer 2 for the coil is transferred on the mother ceramic outer layer block 12A.

Subsequently, as shown in Fig. 7, another conductor pattern layer 2 for the coil is disposed on the mother ceramic outer layer block 12A so as to overlap with the above conductor pattern layer 2 for the coil that is transferred previously. Herein, the conductor pattern layer 2 for the coil is disposed so that a support 21 is disposed at the upper side. Subsequently, the conductor pattern layer 2 for the coil is embedded in the mother ceramic outer

layer block 12A by compression bonding. The support 21 is then peeled off. Thus, the conductor pattern layer 2 for the coil is transferred on the mother ceramic outer layer block 12A.

Subsequently, as shown in Fig. 8, another leading conductor pattern layer 5 is disposed on the mother ceramic outer layer block 12A so as to overlap with the above leading conductor pattern layer 5 that is transferred previously. Herein, the leading conductor pattern layer 5 is disposed so that a support 21 is disposed at the upper side. The end 51 of the leading conductor pattern layer 5 is in contact with an end of the conductor pattern layer 2 for the coil. Subsequently, the leading conductor pattern layer 5 is embedded in the mother ceramic outer layer block 12A by compression bonding. The support 21 is then peeled off. Thus, the leading conductor pattern layer 5 is transferred on the mother ceramic outer layer block 12A.

Subsequently, the above-described transferring of the conductor pattern layer 2 for the coil is repeated two times. As a result, as shown in Fig. 9, two conductor pattern layers 2 for the coil are laminated. The transferring is repeated at a ratio of two conductor pattern layers 2 for the coil to one leading conductor pattern layer 5. Thus, a conductor 2A for a coil composed of ten conductor pattern layers 2 for the coil and a leading conductor 5A composed of

five leading conductor pattern layers 5 are formed. In order to simplify the drawings, the subsequent drawings show a conductor 2A for the coil composed of four layers and a leading conductor 5A composed of two layers (other conductors 3A and 4A for the coil and another leading conductor 6A are also shown in the same way).

Subsequently, as shown in Fig. 10, a ceramic green sheet 10 having a via hole 15 for interlayer connection is laminated on the mother ceramic outer layer block 12A. Subsequently, the transferring of a conductor pattern layer 3 for the coil is repeated ten times on the ceramic green sheet 10 as in the above method such that the conductor pattern layers 3 for the coil overlap with each other (see Fig. 11). As a result, a conductor 3A for the coil composed of ten conductor pattern layers 3 for the coil is formed. The conductor 3A for the coil is electrically connected to the conductor 2A for the coil, with the via hole 15 for interlayer connection therebetween. In these steps, compression bonding is performed after each transferring in order to embed the conductor pattern layers 3 for the coil in the ceramic green sheet.

Subsequently, as shown in Fig. 12, a ceramic green sheet 11 having a via hole 15 for interlayer connection is laminated.

Subsequently, as shown in Fig. 13, the transferring of

a conductor pattern layer 4 for the coil is repeated two times. As a result, two conductor pattern layers 4 for the coil are laminated on the ceramic green sheet 11. Furthermore, a leading conductor pattern layer 6 is transferred thereon such that an end 61 of the leading conductor pattern layer 6 is in contact with an end of the conductor pattern layer 4 for the coil. In these steps, compression bonding is performed after each transferring in order to embed the conductor pattern layers 4 for the coil and the leading conductor pattern layer 6 in the ceramic green sheet.

Thus, the transferring is repeated at a ratio of one leading conductor pattern layer 6 to two conductor pattern layers 4 for the coil. As shown in Fig. 14, a conductor 4A for a coil composed of ten conductor pattern layers 4 for the coil and a leading conductor 6A composed of five leading conductor pattern layers 6 are formed. The conductor 4A for the coil is electrically connected to the conductor 3A for the coil, with the via hole 15 for interlayer connection therebetween.

Furthermore, as shown in Fig. 15, a plurality of ceramic green sheets 12 is laminated thereon and is compression bonded to provide a mother ceramic laminated block 30A. This mother ceramic laminated block 30A is cut according to the arrangement of the conductors 2A to 4A for

the coil and the leading conductors 5A and 6A. In general, the leading conductors 5A and 6A are formed over the cutting line in terms of the tolerance in production. Therefore, mechanical stress during the cutting is directly applied to the leading conductors 5A and 6A. However, since the leading conductors 5A and 6A have a small thickness, the mechanical stress applied to the leading conductors 5A and 6A during the cutting is reduced. As a result, the generation of cracks on the leading conductors 5A and 6A during the cutting can be prevented.

Specifically, the thickness of the conductors 2A to 4A for the coil after the firing was controlled to be 80 μm and the thickness of the leading conductors 5A and 6A after the firing was controlled to be 80 μm. In this known structure, the ratio of crack generation on the leading conductors 5A and 6A was 35%. In contrast, the thickness of the conductors 2A to 4A for the coil after the firing was controlled to be 80 μm, the thickness of the leading conductors 5A and 6A after the firing was controlled to be 40 μm, and the conductor width of the leading conductors 5A and 6A after the firing was controlled to be double of the known structure. In this laminated inductor 1 of the present embodiment, the ratio of crack generation on the leading conductors 5A and 6A was 0%.

Each of the ceramic laminated products 30 cut from the

mother ceramic laminated block 30A is fired. Subsequently, input-output outer electrodes 31 and 32 are formed at right and left end faces of the ceramic laminated product. The input-output outer electrodes 31 and 32 are formed by, for example, applying and baking, sputtering, or vapor deposition.

When a ceramic green sheet composed of ferrite is integrated with a conductor pattern layer for a coil and the integrated component is fired, stress due to the difference in the shrinking behavior is generated. Consequently, the permeability is decreased by the magnetostrictive effect specific to ferrite. Accordingly, among the conductor pattern layers 2, 3, and 4 for the coil, at least the conductor pattern layer for the coil that is brought into contact with the ceramic green sheet 10, 11, or 12 is formed with conductive paste including resin particles that are lost by being fired in the firing process. As a result, the decrease in the permeability due to the magnetostrictive effect can be prevented.

In other words, conductive paste including conductive particles, resin particles, and an organic vehicle is used as the conductive paste of the conductor pattern layer for the coil that is brought into contact with the ceramic green sheet. The volume ratio of the resin particles to the conductive particles is preferably 0.5 to 1. The total

amount of the resin particles and the conductive particles is preferably 30 to 60 volume percent. Resin particles that are lost by being fired at the firing temperature of the conductive particles or a lower temperature are selected.

More specifically, examples of the conductive particles include Ag, Pd, Pt, Au, Ni, Cu, a mixture thereof, and an alloy thereof. Examples of the resin particles having excellent thermal decomposition characteristics include acrylic, methacrylic, polypropylene, polyethylene, polystyrene, polyester, polyolefin, polyisobutylene, and polyethylene glycol resin particles. Polymethylmethacrylate resin having a large compressive strength may be used.

The organic vehicle contained in such conductive paste is composed of an organic binder and a solvent. Examples of the organic binder include ethylene cellulose, acrylic, and butyral resins. Examples of the solvent include a-terpineol, tetralin, and butyl carbitol. The organic vehicle is prepared so that the ratio of the organic binder to the solvent is, for example, 1:9.

Thus, among the conductor pattern layers 2, 3, and 4 for the coil, at least the conductor pattern layer for the coil that is brought into contact with the ceramic green sheet 10, 11, or 12 is formed using conductive paste including resin particles that are lost by being fired in the firing process. In such a case, the resin particles are

lost by being fired during the firing process to form a space between the ceramic green sheet and the inner conductor. As a result, the stress applied to the ceramic green sheet (ferrite) is reduced to prevent the decrease in the permeability due to the magnetostrictive effect. Furthermore, the formation of this space prevents cracks from generating on the inner conductor.

The conductive paste including the resin particles includes a relatively small amount of conductive component. Therefore, in order to provide a reliable connection between the leading conductor pattern layers and the conductor pattern layers for a coil, preferably, the leading conductor pattern layers are not connected to the conductor pattern layers for the coil composed of the conductive paste including the resin particles.

In order to prevent the decrease in the permeability, Fig. 16 shows an example of a preferable connecting relationship between conductor pattern layers for a coil and leading conductor pattern layers. That is, a conductor 4A for a coil is composed of conductor pattern layers 4a to 4f for the coil, and a leading conductor 6A is composed of leading conductor pattern layers 6a to 6c. In this case, conductor pattern layers 4a and 4f for the coil, which are brought into contact with the ceramic green sheets 12 and 11, respectively (see Fig. 1), are formed using conductive paste

including resin particles that are lost by being fired in the firing process. Conductor pattern layers 4b to 4e for the coil formed using conductive paste that does not include such resin particles are connected to the leading conductor pattern layers 6a to 6c.

The use of conductive paste including the resin particles as the leading conductor pattern layers 5 and 6 is not necessarily preferable. The reason for this is as follows. When a space is formed between the leading conductor pattern layer 5 or 6 and a ceramic green sheet, a problem, for example, the entering of a plating solution from the outside may occur.

The present invention is not limited to the above embodiments and can be variously modified within the scope of the content. In addition to the laminated inductor, examples of the laminated ceramic electronic component include a laminated common mode choke coil, a laminated transformer, a laminated impedance component, a laminated LC filter, and a high frequency line device having a strip line or a micro strip line.

In the above embodiment, one leading conductor pattern layer 5 and two conductor pattern layers 2 for a coil are transferred alternately. These layers are not necessarily transferred alternately. For example, after all the conductor pattern layers 2 for a coil are transferred, the

leading conductor pattern layers 5 may be transferred.

Furthermore, in the above embodiment, the leading conductor pattern layer 5 and the conductor pattern layer 2 for a coil are formed separately. Alternatively, the leading conductor pattern layer 5 and the conductor pattern layer 2 for a coil may be formed at the same time. For example, as shown in Fig. 17(A), a leading conductor pattern layer 5 and a conductor pattern layer 2 for a coil are formed as an integrated part on a carrier film 21. As shown in Fig. 17(B), only the conductor pattern layer 2 for the coil is formed on a carrier film 21. Subsequently, these carrier films may be transferred alternately.

The method for producing a laminated ceramic electronic component according to the present invention is not limited to a method in which an inner conductor and a leading conductor are formed by transferring. Alternatively, in the method, the inner conductor and the leading conductor may be formed on a ceramic green sheet by, for example, screen printing.

Industrial Applicability

As described above, the present invention is useful for a laminated inductor, a laminated impedance component, a laminated transformer, a high frequency line device, and the like. In particular, the present invention is excellent in that excessive mechanical stress is not readily applied to a

leading conductor during the cutting.